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General Nuclide Identification with PeakEasy

*Spectroscopic Alarm
Adjudication Course*

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Objective

List the basic steps of doing nuclide identification

- Use pattern recognition
- Check energy calibration
- Compare the “unknown” spectrum to a background spectrum
- Use energy search method
- Specifically look for SNM
- Use PeakEasy Library Spectra
- Be able to explain everything in the spectrum



Problem Statement

You are given the following spectra:

- Item of Primary Concern (IPC)
- Background (BG)
- Conduct Nuclide Identification

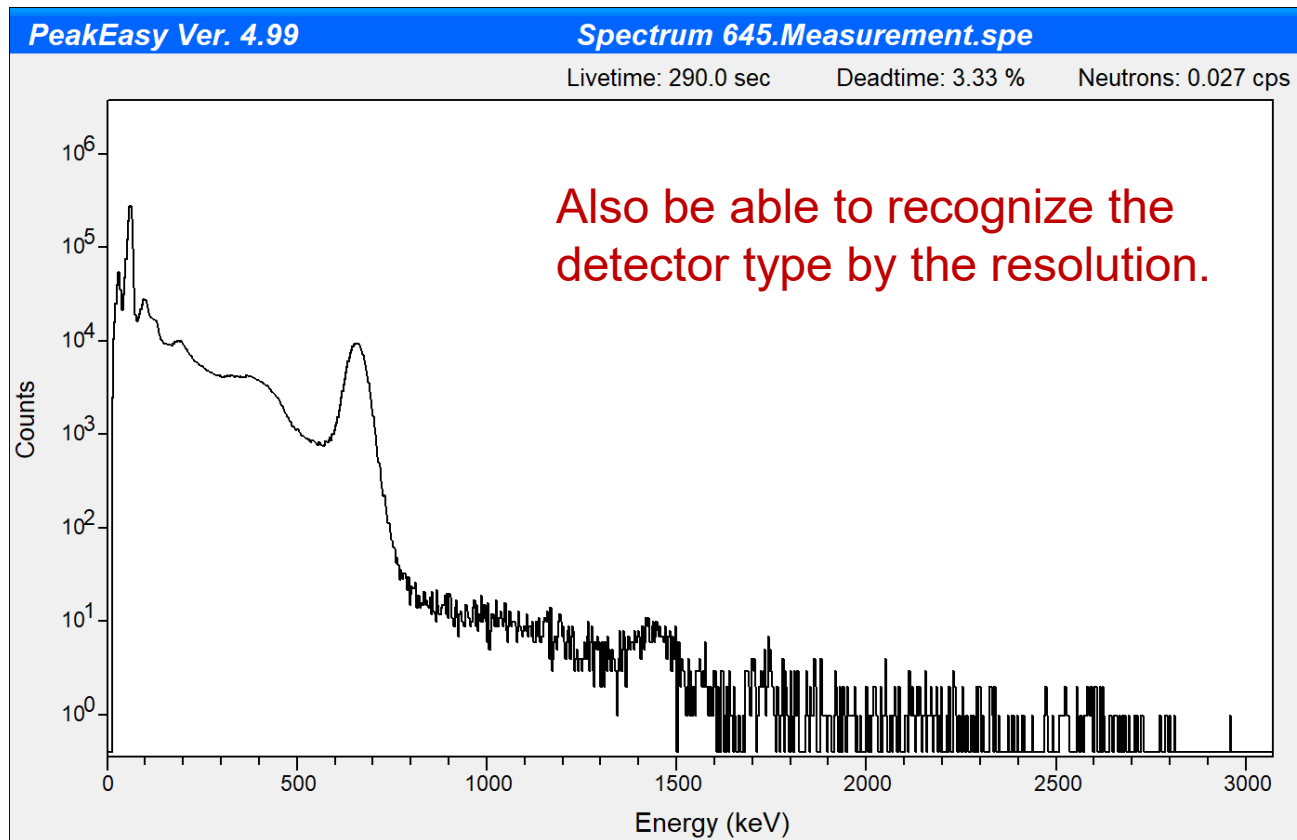


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Pattern Recognition

If you have experience in recognizing gamma-ray spectral patterns, look at the IPC spectrum first.

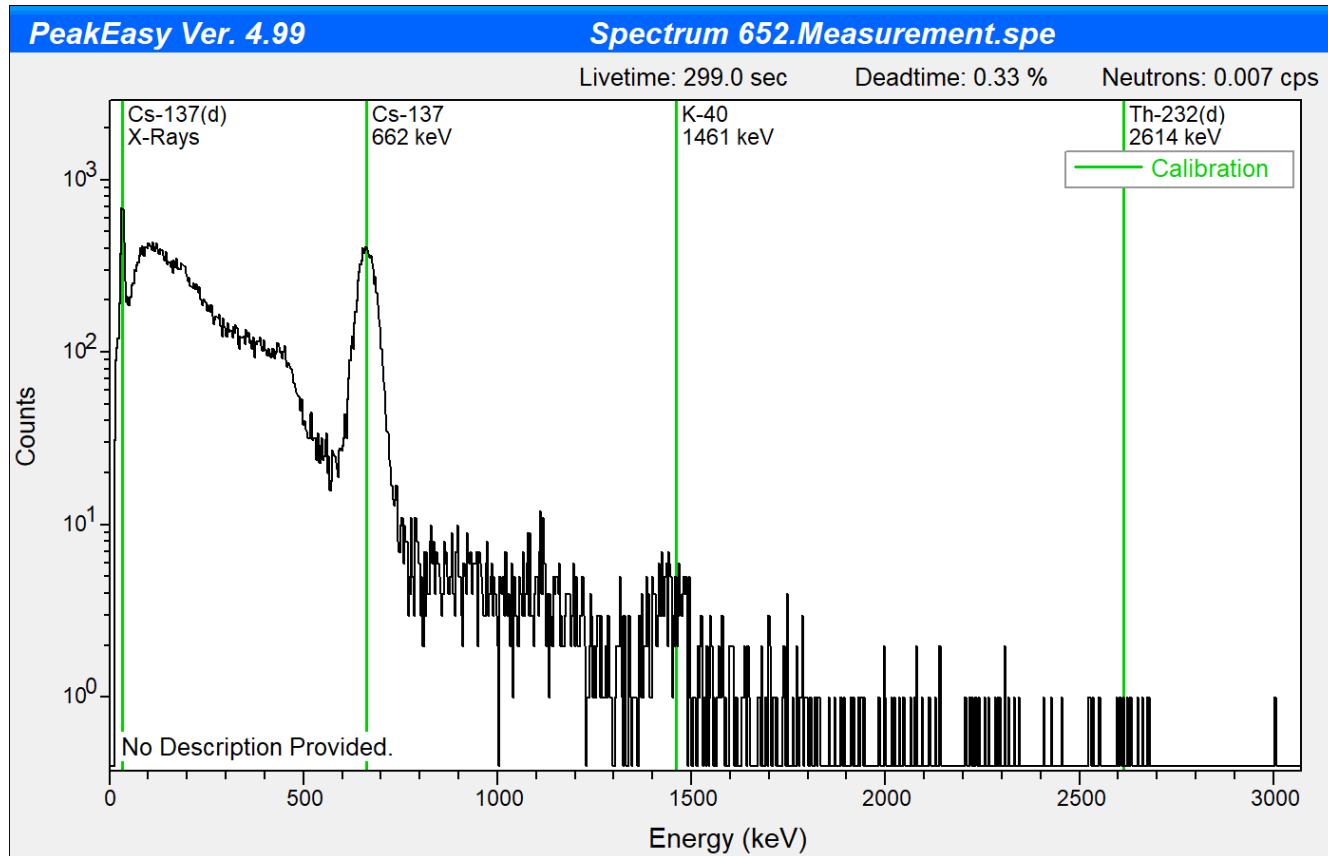


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Check Energy Calibration

You may be able to use the background and internal seed signature to check energy calibration.



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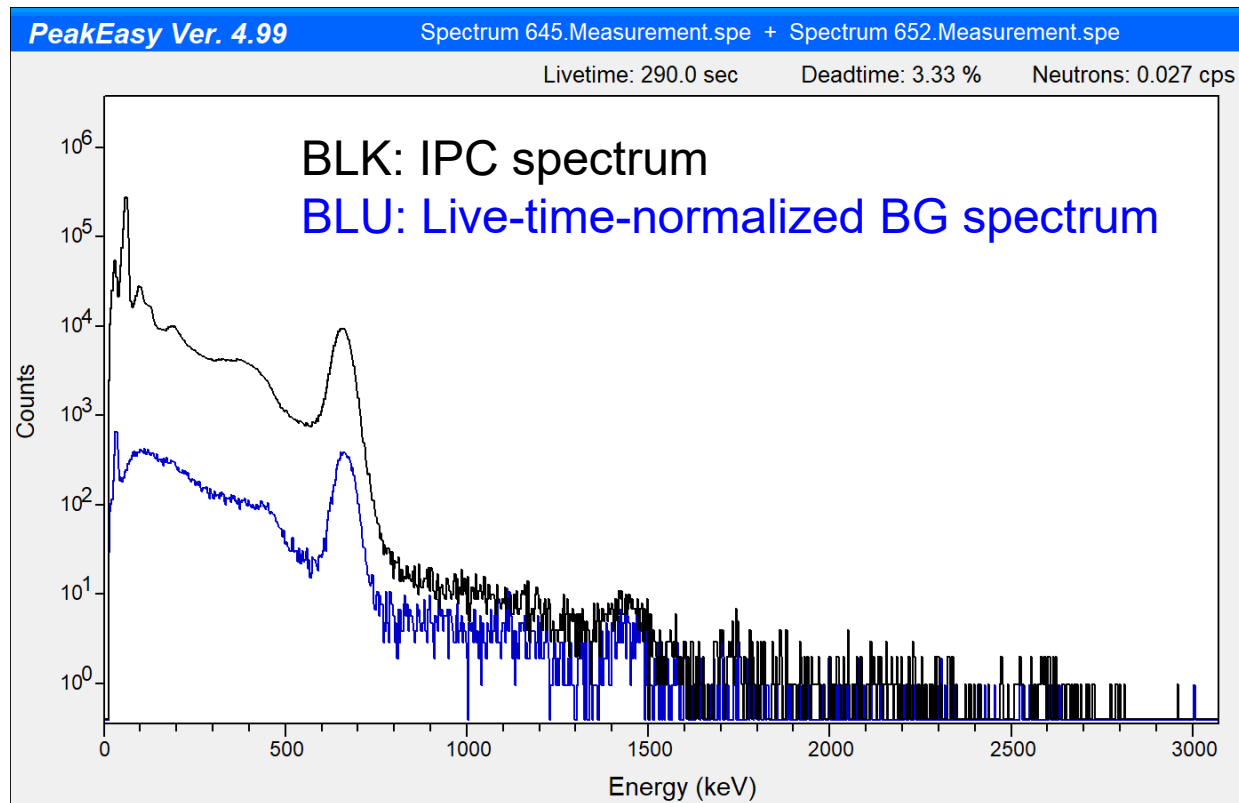
QUESTION

- For the spectrum on the previous slide, name two things you should do to check the calibration for the Cs X-ray(s) energy?
 - HINT: One thing has already been done on the previous slide



Compare IPC with Background

Normalize the background by live time and look for those features in the IPC spectrum that do not appear in the background.

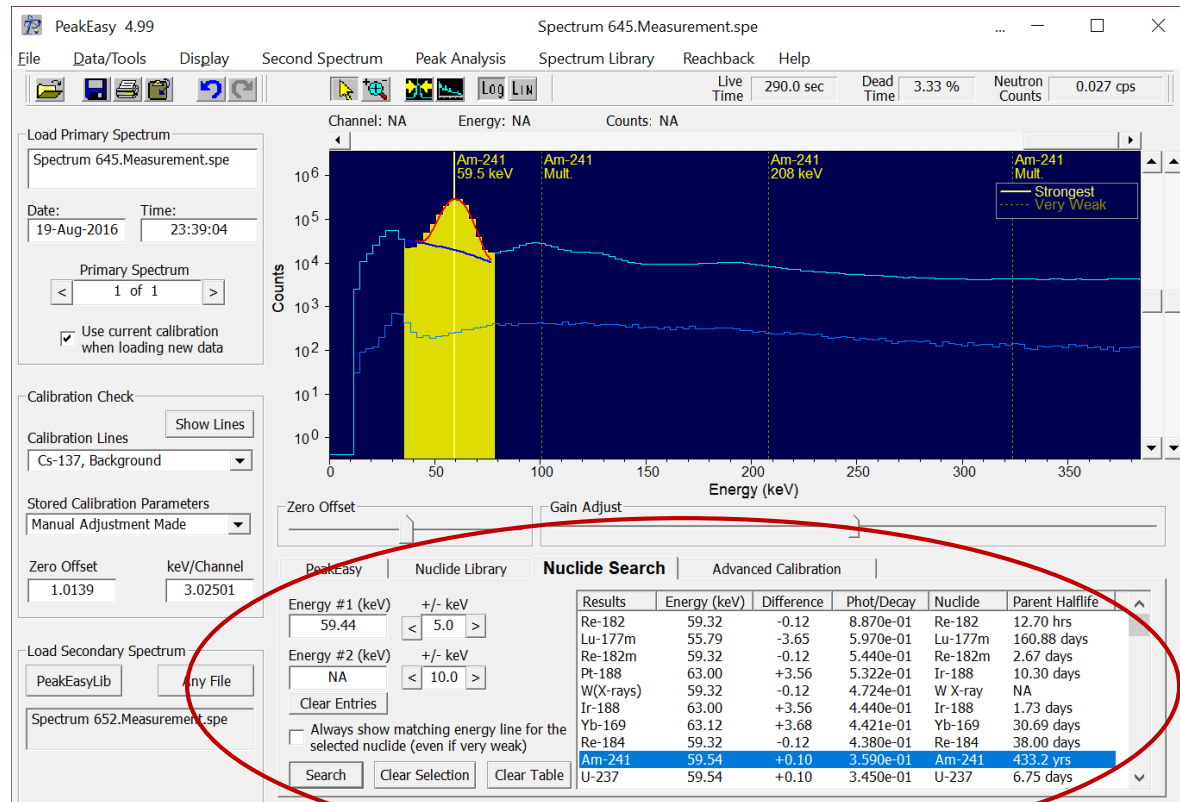


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Search on Peak Energies

You can search on peak energies with a resolution-appropriate tolerance.



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QUESTION

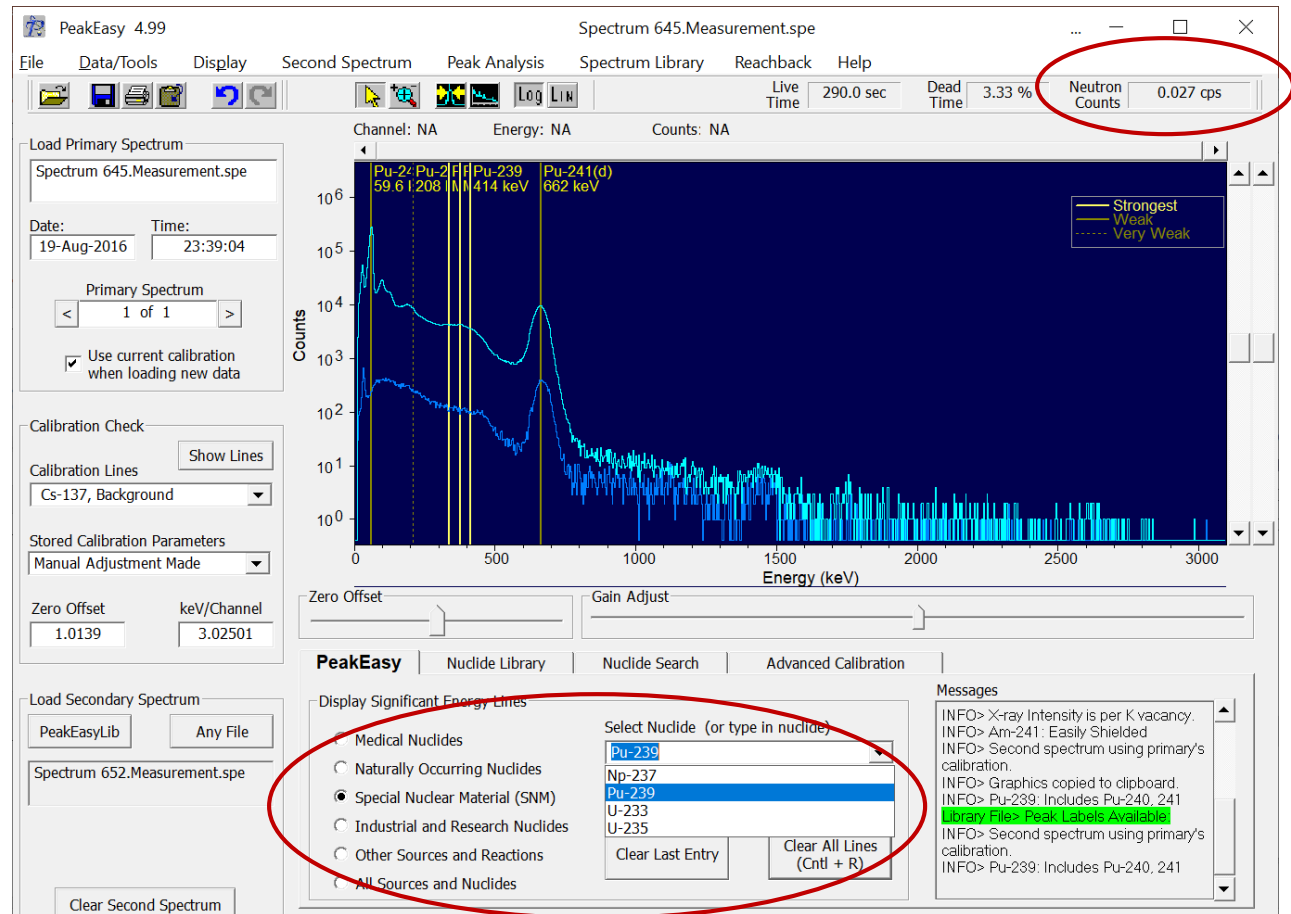
- Give an example where searching on two peak energies simultaneously can lead to a poor ID candidate.



Specifically Look for SNM

Even if you think you know what it is, look for SNM!

- Direct SNM Gammas
- Neutron rate above BG
- (n, γ) & (n,n', γ) Lines
- Counts above 2614



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PeakEasy Library Spectra

Use PeakEasy Library spectra to help with identification

The screenshot displays the PeakEasy 4.99 software interface. The main window shows a spectrum plot with 'Counts' on the y-axis (log scale from 10⁰ to 10⁶) and 'Energy: NA' on the x-axis. A red arrow points from the 'PeakEasyLib' button in the 'Load Secondary Spectrum' section to the 'Documents' folder in the file selection dialog. The dialog shows a list of files under the path 'Plutonium > Pu-239 (Various % Pu-240) > NaI'. The selected file is 'Pu-239 Oxide (6% Pu-240) IdentIFINDER (NaI)'. The 'File name' field in the dialog also contains this text. The 'Database Files (*.SPE)' dropdown is set to 'Open'. The 'Clear All Lines (Ctrl + R)' button is visible at the bottom right.

PeakEasy 4.99

Spectrum 645.Measurement.spe

File Data/Tools Display Second Spectrum Peak Analysis Spectrum Library Reachback Help

Live Time 290.0 sec Dead Time 3.33 % Neutron Counts 0.027 cps

Channel: NA Energy: NA Counts: NA

Load Primary Spectrum

Spectrum 645.Measurement.spe

Date: 19-Aug-2016 Time: 23:39:04

Primary Spectrum

< 1 of 1 >

☒ Use current calibration when loading new data

Calibration Check

Calibration Lines Show Lines

Cs-137, Background

Stored Calibration Parameters

Manual Adjustment Made

Zero Offset 1.0139 keV/Channel 3.02501

Load Secondary Spectrum

PeakEasyLib Any File

Zero Offset

Display Significant

☐ Medical Nucleides

☐ Naturally Occurring

☒ Special Nucleides

☐ Industrial and Research Nucleides

☐ Other Sources and Reactions

☐ All Sources and Nucleides

Clear Last Entry

Clear All Lines (Ctrl + R)

File name: Pu-239 Oxide (6% Pu-240) IdentIFINDER (NaI)

Database Files (*.SPE)

Open Cancel

INFO> Graphics copied to clipboard.
INFO> Pu-239: Includes Pu-240, 241
Library File> Peak Labels Available

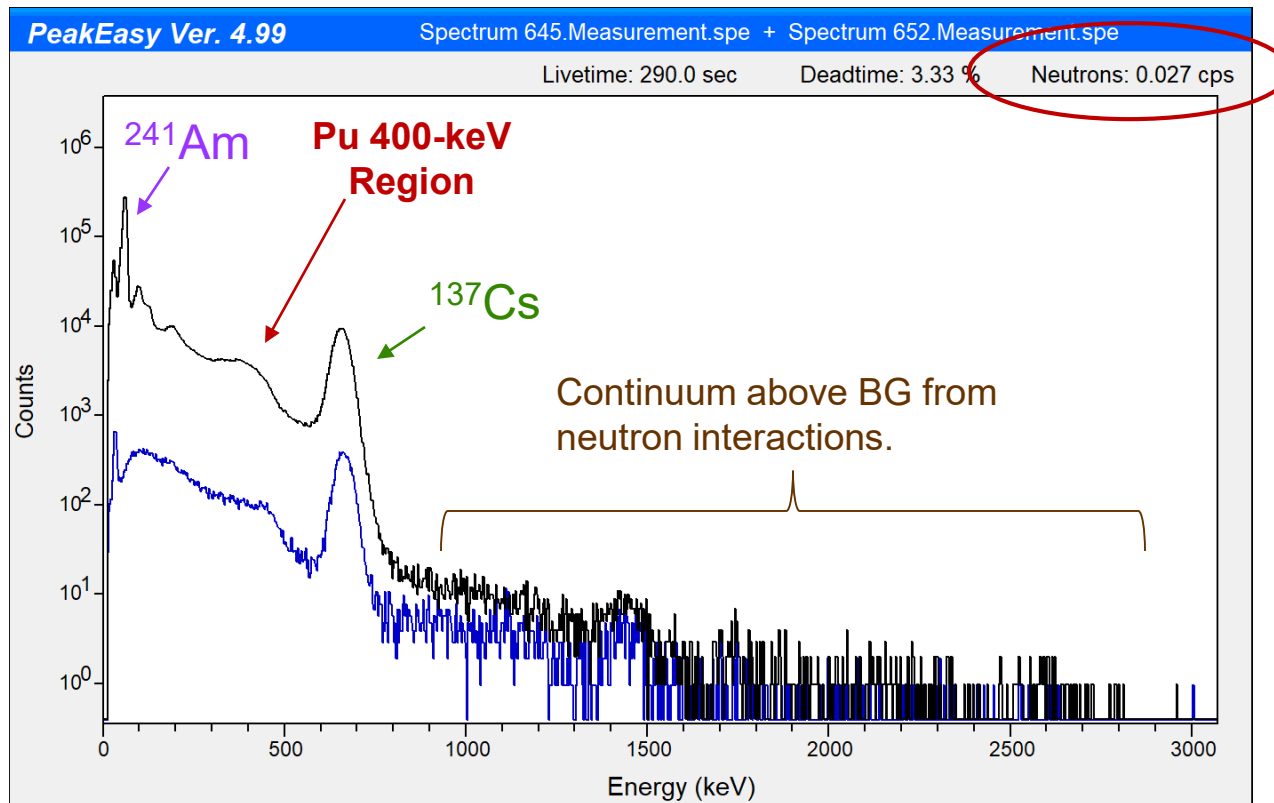


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Explain Everything in the Spectrum

You are not finished until you can explain everything in the spectrum.



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QUESTION

- Why should you **not** normalize by live time when comparing PeakEasy library spectra to your IPC?



Summary

- Pattern recognition can help you with ID and calibration
- Search on energies only after you have calibrated
- You can use the background to calibrate
- Compare the “unknown” IPC spectrum to a background spectrum
- Specifically look for SNM - always – ZOOM IN!
- You are not done until you can explain everything in the spectrum

